

Enabling extended enterprise design/analysis validation processes

Nigel Shaw, Eurostep Limited

April 2009

Overview

- » **The CFMS project**
- » Collaborative information management of Validation and Verification
- » The CFMS Validation and Variation Knowledge Base
- » The view from within Share-A-space
- » Exploitation benefits

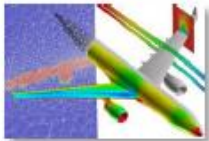
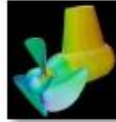
Why was CFMS launched?

Marine sector

Cost reduction

Design for “real sea conditions” performance

Hull/propulsor integration



Aerospace sector

Reduced development and operating costs

Cycle time reduction

Improved environmental performance

Accreditation by simulation



Automotive/motorsport

Development cost reduction

“Real road conditions” simulation

“Quick turn-round” product enhancements

Product optimisation within tight constraints



- Reduced product development & operating cost
- Reduced time to market
- Design for increased product complexity / optimisation

Other sectors, including

Construction

Renewable energies

Oil & gas

Process Engineering

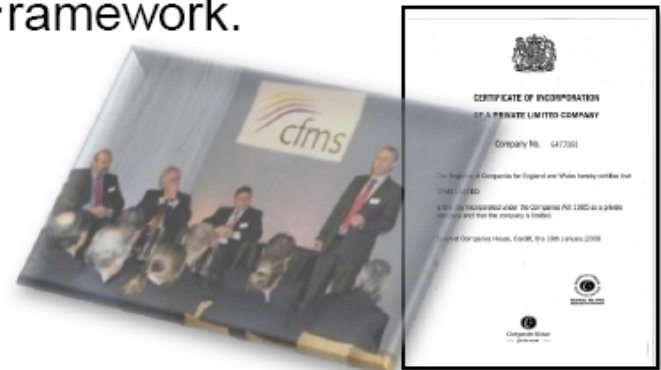
Medicine and healthcare



What is CFMS?

- A co-ordinated vision is required to focus capability development and ensure relevance to customer requirements
- The **CFMS Vision** is structured around the following strap-lines:
 - *Full simulation - no test*
 - *Engineer as innovator rather than calculator*
 - *Right first time / optimal first time*
- The Vision is

..... to drive a sustainable framework of challenging research and technology application that will revolutionise the capability of engineering design simulation processes.
- CFMS Ltd, a not for profit company, has been established to manage delivery of the CFMS Vision via the CFMS Framework.
- The four business streams of CFMS Ltd are:
 - Vision realisation
 - Project scoping and facilitation
 - Project management support
 - Facilities provision



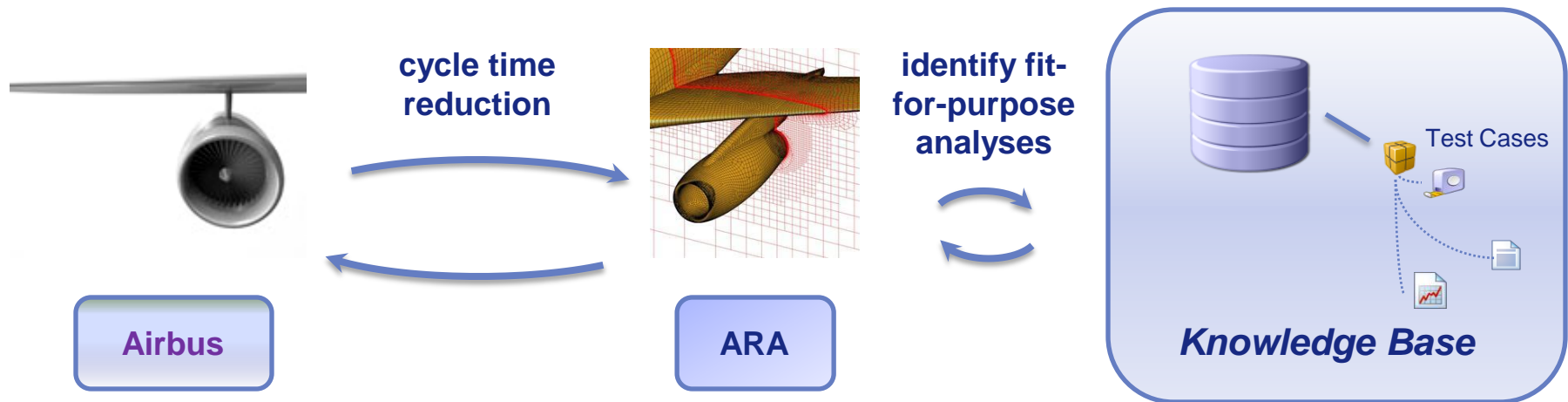
Overview

- » The CFMS project
- » **Collaborative information management of Validation and Verification**
- » The CFMS Validation and Variation Knowledge Base
- » The view from within Share-A-space
- » Exploitation benefits

Business Problem

- » Airbus want to reduce the cycle time for design analysis
- » Airbus and ARA are using CFMS to embrace new technologies and methods to keep them at the forefront of CFD modelling
 - automatic fit-for-purpose mesh generation from customer geometry
 - feature driven meshing and modelling
- » Collaborative Information management supports these aims because “cycle time reduction” and “fit-for-purpose” require Airbus to:
 - better control and automate their customer collaboration
 - know what geometry is available where
 - know what pre-existing analyses match the “purpose”
- » Establishing a validation and verification knowledge base supports these aims as it identifies results and features of most relevance

Business Problem

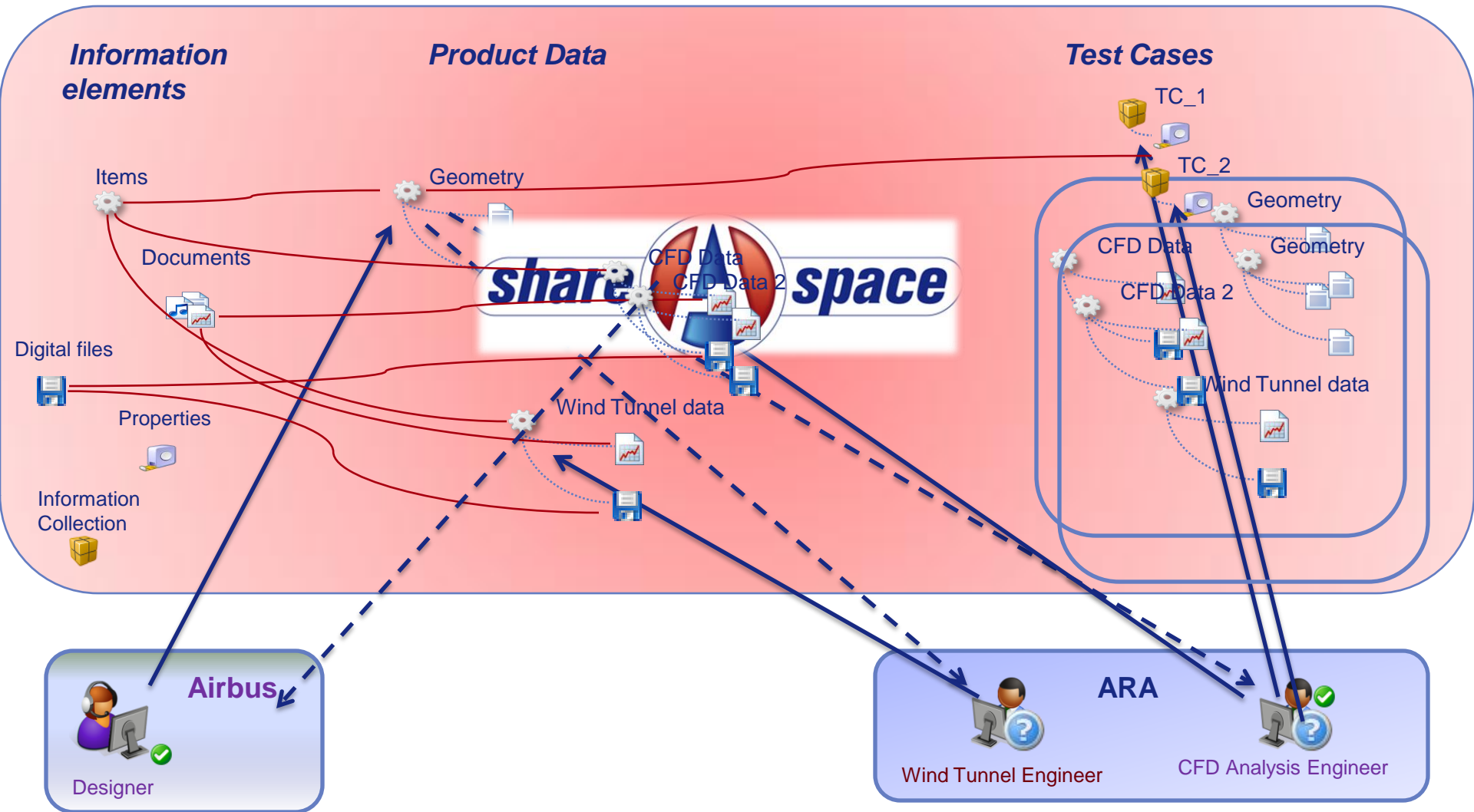


- » Key Tasks in making this happen
- Establish collaboration partners
 - Establish information elements and put under configuration control
 - Automatically notify partners of information uploads
 - Create Test Cases
 - Search and access Test Case Data
 - Establish knowledge base for Verification and Validation data

User Scenario

- » ARA and Airbus establish collaboration area in Share-A-space
- » Relevant geometry data uploaded by Airbus into Share-A-space.
- » Upon creation of new data or modification of existing data, Share-a-space will notify ARA.
- » ARA downloads the new geometry and carries out a CFD run
- » ARA can also search Share-A-space for relevant data that has already been uploaded.
- » Having completed the CFD run (or wind-tunnel test) ARA uploads the results into Share-A-space and provides any relevant additional information to the database
- » Share-A-space automatically notifies Airbus
- » Share-A-space acts as a knowledge base for the Airbus and ARA, providing a coherent set of test case records.
- » The above scenario can be carried out in either the native Share-A-space GUI or through a customized web-service client.

Animated Storyboard



Sharing Test Cases using Share-A-space

The screenshot shows the Share-A-space web application running in Microsoft Internet Explorer. The browser window title is "Share-A-space - sas_2 | 6.0.8 - Microsoft Internet Explorer". The address bar shows the URL: <http://localhost/Share-A-space/main/frameSet/SASFrameSet.aspx>.

The application interface includes a sidebar on the left with navigation links: New..., Personal, Tools, Security, Workflow, Project Setup, and Information. The main content area displays the details of a test case titled "ONERA M6 wing, 1, Standard aerospace testcase".

User Information:

- Craig Johnston, ARA**
- Project Role:** Administrator, ARA
- Application Context:** Physical Experiment AnalyticExperiment MecDes
- Effectivity:** 30/10/2008 16:14:03 : Actual
- Identifier Context:** ARA

Test Case Details:

- Description:** Standard testcase used throughout aerospace - ONERA wind tunnel data available, plus a variety of test cases. **Level State:** Not In Level State System
- Creator:** Craig Johnston
- Created Date:** 10/10/2008 05:01:49
- Owner:** ARA

Content of information collection:

- ONERA M6 wing, 1, Standard aerospace testcase
 - m6 mach7, 1, Flow Solution mach 7 [AnalyticExperiment]
 - m6 post_proc, 1, post_proc [AnalyticExperiment]
 - m6 Surface Mesh, 1, Surface mesh [AnalyticExperiment]
 - m6, 1, 3D wing [MecDes]
 - ExptCP_445span, 1, ExptCP_445span [Physical Experiment]
 - ExptCP_805span, 1, ExptCP_805span [Physical Experiment]
 - ExptCP_905span, 1, ExptCP_905span [Physical Experiment]
 - m6 mach8, 1, Flow Solution mach 8 [AnalyticExperiment]

Operations:

- Edit
- View
- Contents (highlighted)
- Approval Status

The status bar at the bottom shows the URL: <http://localhost/share-a-space/main/browse/informationCollectionContent.aspx?selectedBoid=21726&> and the time: 16:16.

Searching for Test Cases using dedicated Web Services GUI

The screenshot displays the 'CFMS Validation & Verification Client' application. The main window has a menu bar (File, Tools, Help) and a toolbar with 'Search Test Cases' and 'Create Test Case' buttons. The 'Search Test Cases' section includes input fields for 'Id' (ONERA M6 Wing), 'Name', and 'Description', along with dropdowns for 'Geometry Format' (DAT) and 'Mesh Generator' (Solar). A 'Search' button is present. Below this is a table with columns 'TestCase Id', 'TestCase Name', and 'Description'. The first row shows 'ONERA M6 Wing', 'Standard aerospace testcase', and 'Standard Testcase used throughout aerospaceOnera Wind Tun...'. An overlay window titled 'CFMS Verification and Validation Server' provides detailed information for the selected test case. It includes a 'Test Case Information' section with fields for 'Id' (ONERA M6 Wing), 'Name' (Standard aerospace testcase), and 'Description' (Standard Testcase used throughout aerospaceOnera Wind Tuning. All data available,, plus a variety of test cases.). Below this is a 'Properties' section with a table listing various parameters and their values.

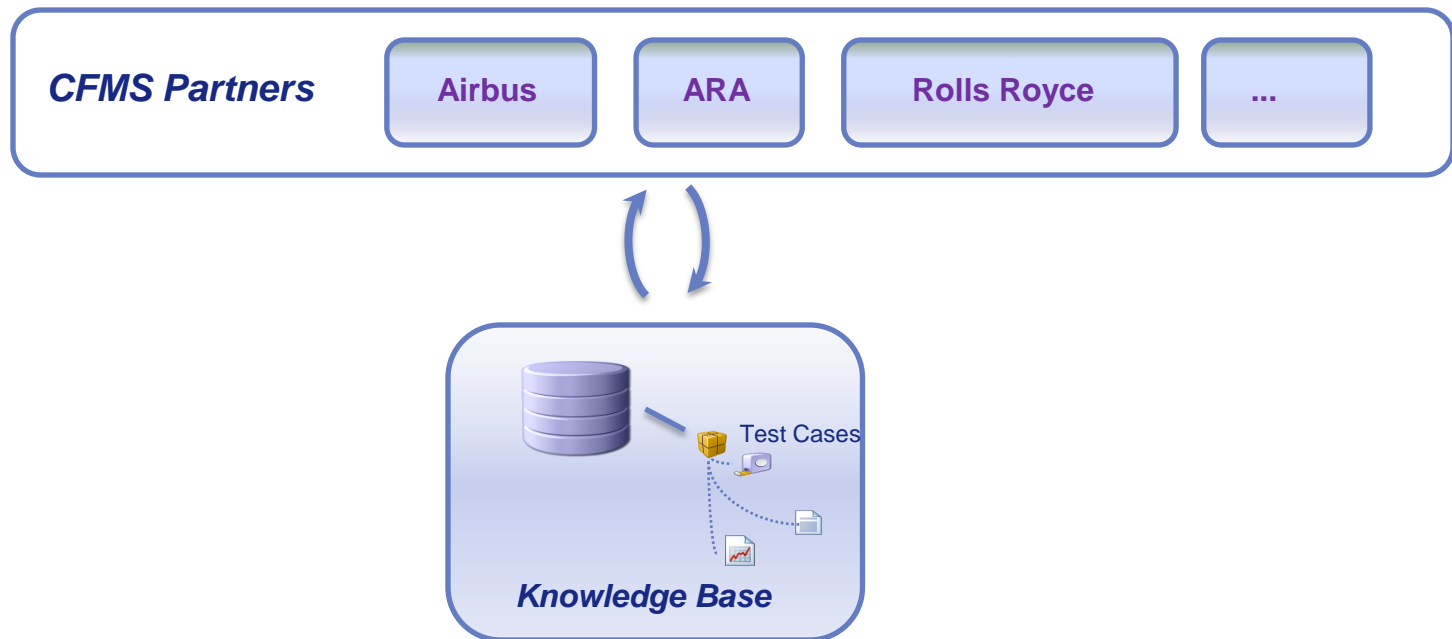
Property	Value
Geometry Format	DAT
aircraft	wing
Mesh Generator	Solar
Flow Solver	Tau

At the bottom of the overlay window, there are buttons for 'Add Property', 'Add DOAP', 'Add Geom', 'Add Asys', and 'Add Phys'.

Overview

- » The CFMS project
- » ARA collaborative information management of Validation and Verification at ARA
- » **The CFMS Validation and Variation Knowledge Base**
- » The view from within Share-A-space
- » Exploitation benefits

Validation and Verification Knowledge Base



- » The aim is to provide a shared repository of validation test cases for CFMS by
 - ensuring access to Knowledge Base to all CFMS partners
 - allowing controlled access to test data for the standard CFD processes (e.g., geometry, meshes, solutions and post processing data)
- » The V&V knowledge base is not intended to store more complex analysis process chains such as static coupling and design optimisation
- » Future extensions may include unsteady data and adaptive solutions

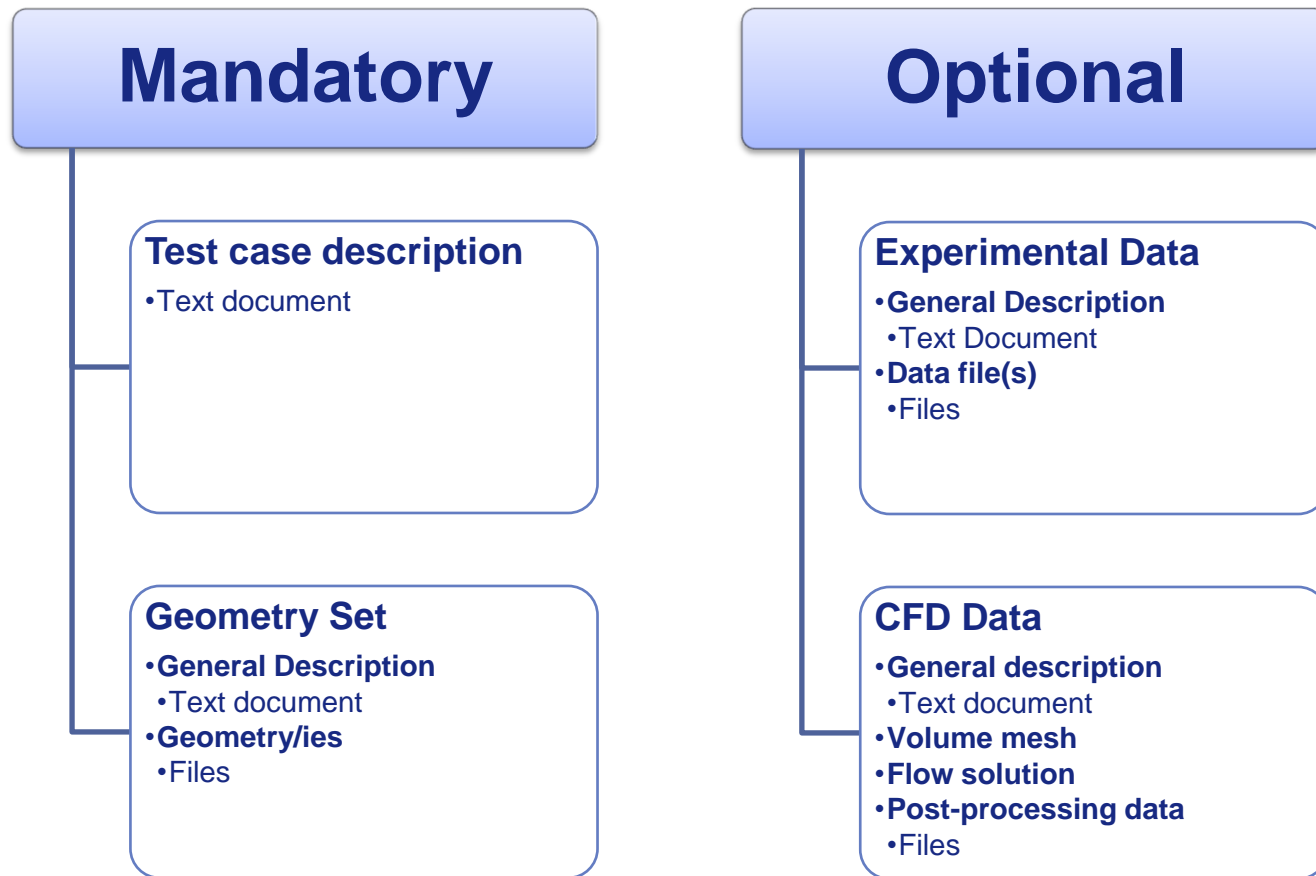
Validation and Verification Knowledge Base

Test Case Identification

- » Several possible interpretations for test case:
 - Single geometry, multiple simulations/experiments under a range of physical conditions
 - Set of slightly different geometries under the same physical conditions
- » For purposes of V&V Knowledge base
 - May have multiple physical conditions
 - May have multiple geometries
 - Conditions and/or geometries must be related
- » Examples:
 - Multiple flap settings of the same aircraft
 - » single test case
 - Cruise and high-lift versions of the same aircraft
 - » different test cases
- » Exact cut-off point left to judgment of the test case provider

Validation and Verification Knowledge Base

Test Case Description



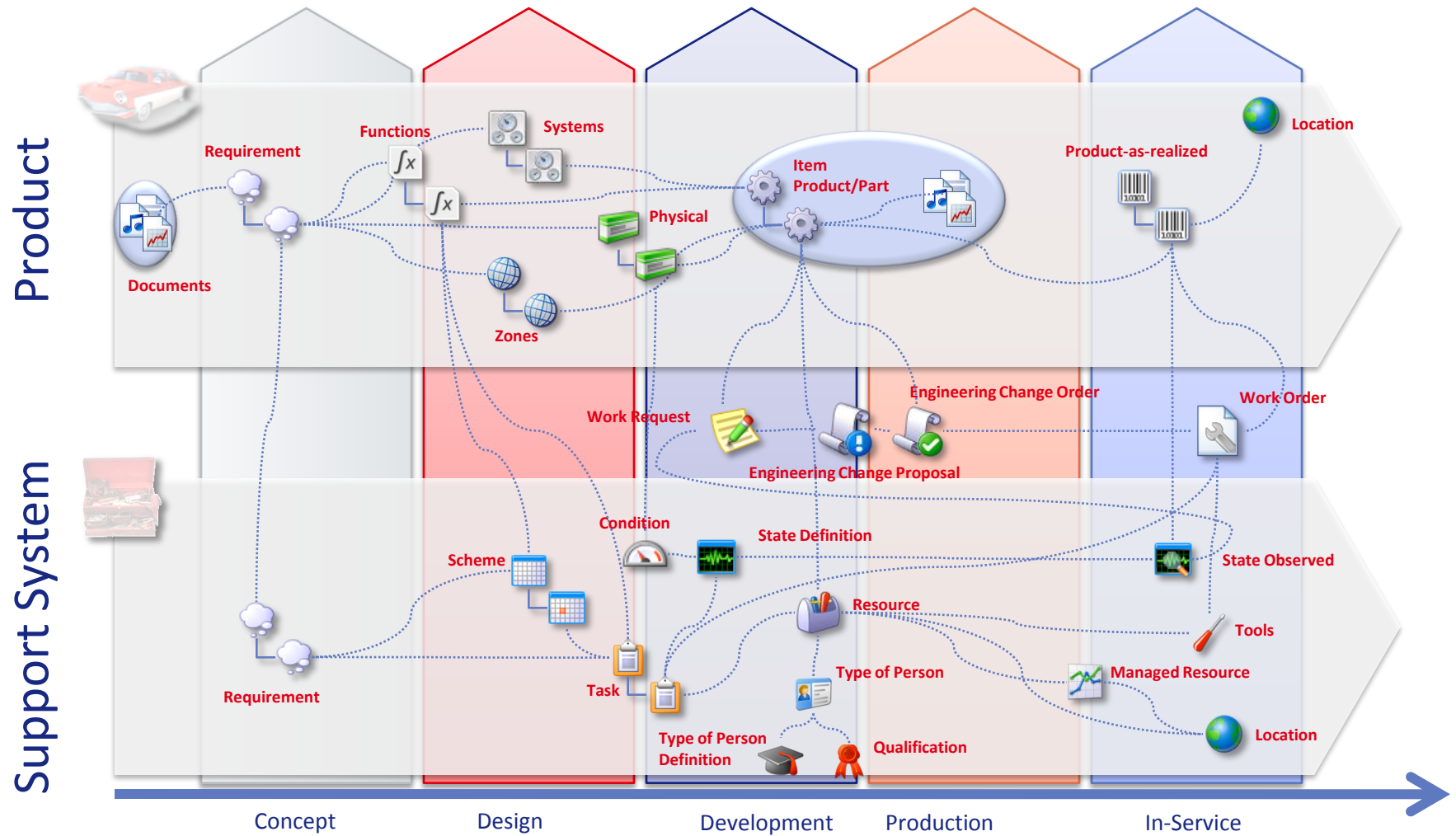
Validation and Verification Knowledge Base

- » Approach to growing the knowledge base has to be pragmatic and strike balance between rigour and ease-of-use
 - Incomplete test cases are acceptable
 - » E.g. Geometry with no accompanying experimental or simulation results
 - Specific file formats are not mandated
 - » Formats must be described suitably
 - No requirement for formal peer-review to determine acceptability
 - » Expected that within the collaborative context of CFMS, communication with the test case provider will prove a sufficient mechanism for problem resolution
- » Test cases can be collaborative and dynamic:
 - One partner provides geometry and experimental data
 - Other partners add CFD data as simulations are performed

Overview

- » ARA collaborative information management of Validation and Verification at ARA
- » The CFMS Validation and Variation Knowledge Base
- » **The view from within Share-A-space**
- » Exploitation benefits

Main Business Objects in Share-A-space



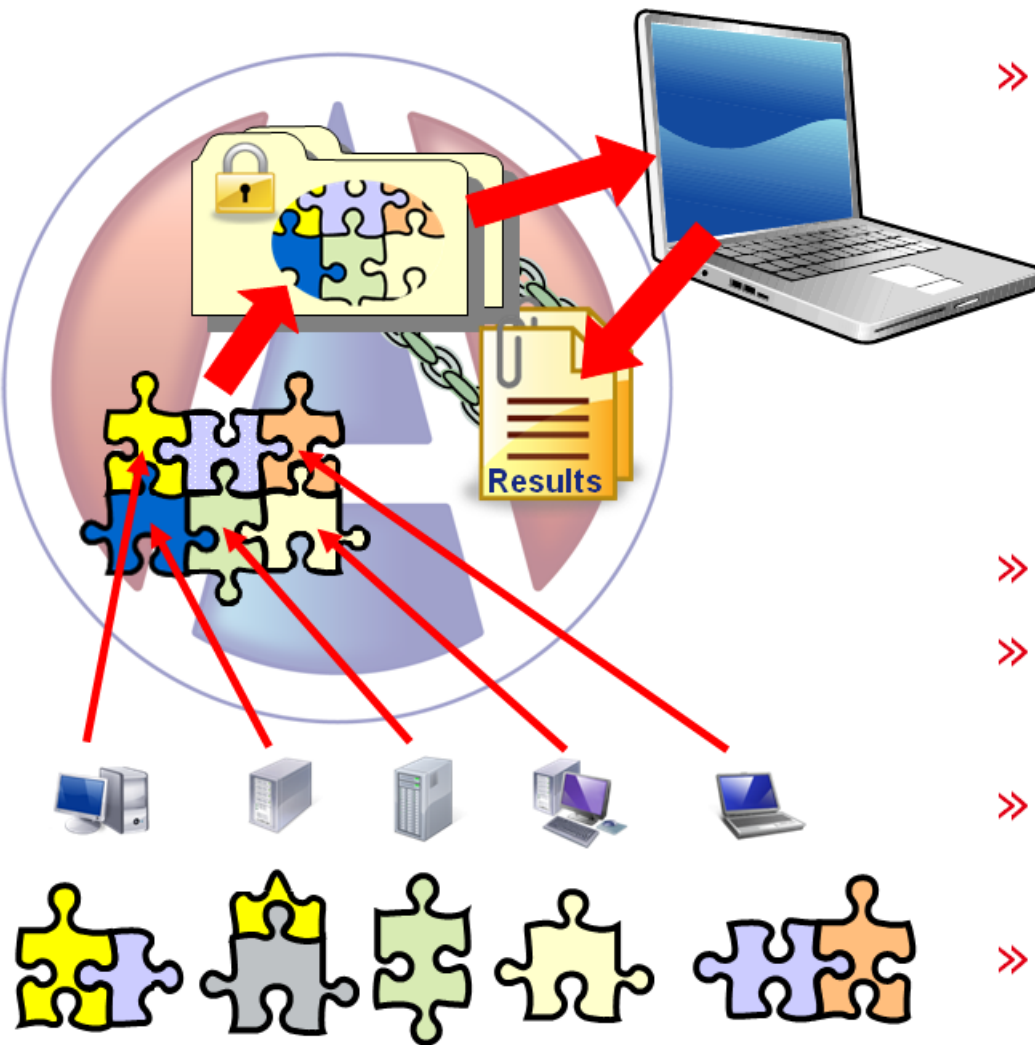
Overview

- » ARA collaborative information management of Validation and Verification at ARA
- » The CFMS Validation and Variation Knowledge Base
- » The view from within Share-A-space
- » **Exploitation benefits**

CFMS related exploitation

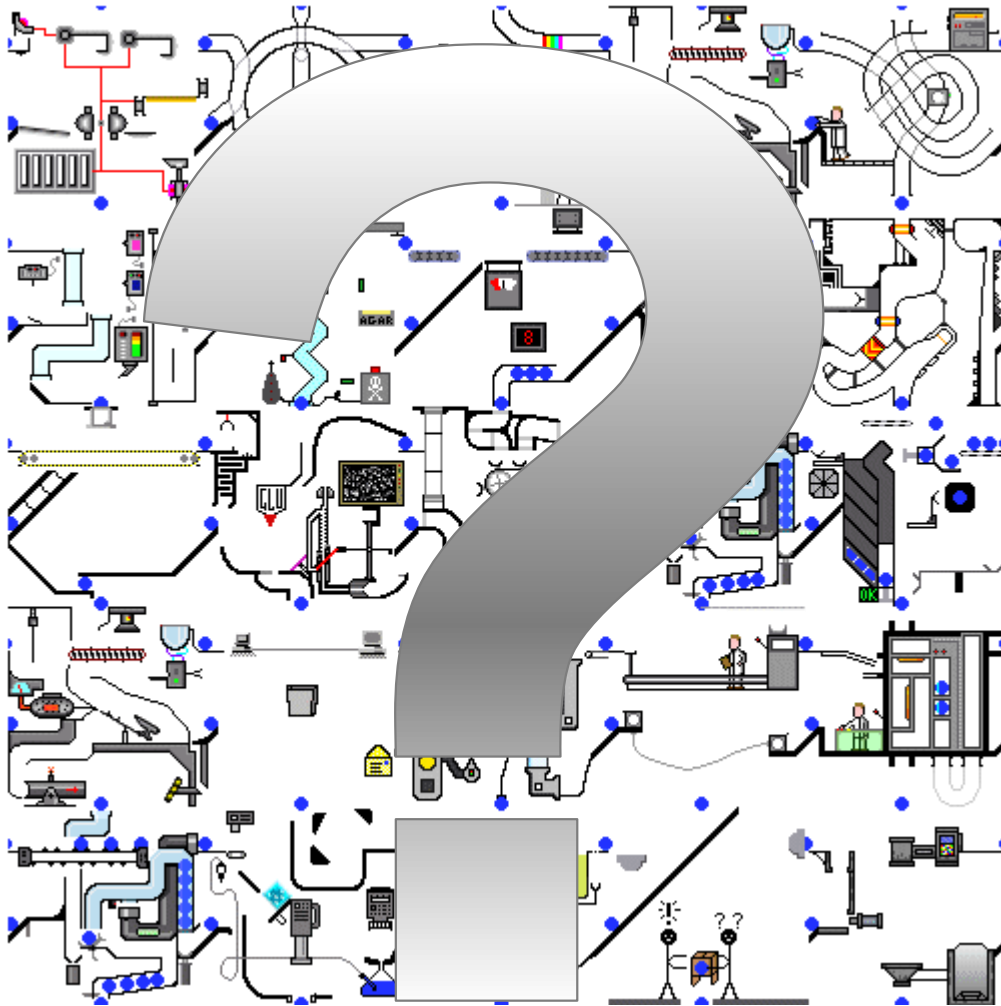
- » Benefits to ARA and Airbus
 - Trial internal process improvement ideas for
 - » Searching for fit-for-purpose analysis results
 - » reducing cycle time
 - Early access to new technologies
- » Benefits to CFMS Core Programme
 - Improved integration across programme by facilitating sharing of V&V data
- » Benefits to Eurostep
 - Requirements gathering and confirmation for Share-A-space usage in UK Aerospace and Defence sector
 - » Core product can support a CFD related business scenarios
 - » Further insight to V&V search and access needs
 - Further development of web services interfacing skills
 - » Already been used to support commercial projects

Information consolidation for analysis history



- » Analysis often requires as input an information set that is held across multiple disconnected systems
 - Possibly with overlaps/duplication
 - Affected by change
- » Consolidate the input data
- » Track results against the input data
- » Complete audit trail ensures traceability and reduces effort
- » Applies across organizations

Any questions?



Nigel Shaw
Eurostep Limited
nigel.shaw@eurostep.com
www.eurostep.com

For more info on


cfms
www.cfms.org.uk